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GEOLOGY.—*The Chesapeake Miocene basin of sedimentation as expressed in the new geologic map of Virginia.*[1] W. C. MANSFIELD, U. S. Geological Survey. (Communicated by L. W. STEPHENSON.)

INTRODUCTION

The revision of the Chesapeake group of the Coastal Plain of Virginia shown on the new geologic map of Virginia is the result of field and office work carried on at different times since the year 1918. The inner margin of the group as shown is taken in part from previous maps, but some additional work on this boundary in Virginia was done by R. P. Meacham, of the Virginia Geological Survey, and by me.

In Maryland the Miocene stratigraphy has been admirably worked out. The results were published in 1904 as the Miocene volume of the Maryland Geological Survey, and form a working basis for interpreting the stratigraphic sequence of the deposits to the south.

The abundant molluscan faunas preserved in most of the deposits afford reliable data for determining the horizons and the age relationships. Each bed carrying a distinctive fauna has been traced inland as far as possible up the major valleys.

On the map, Figure 2, which is later discussed, I have extended my observations, for completeness, into North Carolina, although I have not so thoroughly studied the faunas there as in Virginia.

CHESAPEAKE GROUP

DIVISIONS AND THICKNESS

The Chesapeake group of Virginia is divisible into four formations, which in ascending order are: Calvert, Choptank, St. Marys, and Yorktown. The Yorktown has not been recognized in Maryland.

[1] Published by permission of the Director of the U. S. Geological Survey. Read before the Geological Society of America December 26, 1928. Received April 22, 1929.

The thickness of the Chesapeake group of Virginia, as observed from the exposures, is estimated to be 575 feet. This estimate corresponds closely to that part (about 550 ft.) assigned by Darton[2] to the Chesapeake group in a well boring at Fort Monroe in southeastern Virginia. The total thickness of the Chesapeake group, as reported by Woolman[3] in the wells at Crisfield, on the eastern shore of Maryland, is 719 feet. These wells are southeast of the outcrops of the Chesapeake group

TABLE 1.—TABLE SHOWING CLIMATIC CONDITIONS INDICATED BY THE MOLLUSCAN FAUNAS OF THE CHESAPEAKE GROUP

Formations		*Suggested climatic conditions*	*Latitude of most closely related off-shore Recent fauna*
Yorktown	Upper part (fragmentary beds and beds at Suffolk)	Approaching warm temperature	A little farther south
	Lower part (below fragmental series and lower bed at Grove Wharf)	Cool temperate	About the same or farthert north
St. Marys	(Later beds in Virginia)	Moderately cool temperate	About the same, suggesting farther south
	(Upper beds in Maryland)	Approaching warm temperate	Farther south
Choptank		Cool temperate	About the same or perhaps a little farther south
Calvert		Approaching warm temperate	Farther south

along the Chesapeake Bay, in Maryland, and the greater thickness indicates that the beds thicken down the dip.

Sanford[4] states that well records indicate that the bottom of the Chesapeake group lies 600 feet below tide-water at Fleet Point, Northumberland County, Va. These wells are nearly north of Fort Monroe, where the thickness of the Chesapeake group was reported to be about 550 feet. This would indicate that the thickness of that part of the Chesapeake group below the Yorktown formation is greater in the northern part of the State than in the southern part.

[2] N. H. DARTON. U. S. Geol. Surv. Geol. Atlas, Norfolk folio, no. 80, p. 3. 1902.
[3] LEWIS WOOLMAN. New Jersey Geol. Surv. Ann. Rept. 1894: 184. 1895.
[4] SAMUEL SANFORD. Va. Geol. Surv. Bull. 5: 249. 1913.

DISTRIBUTION

The inner or western limits of the Miocene formations in Maryland, Virginia, and the Carolinas are shown on the accompanying map (Fig. 2), the data for Maryland being taken from the Maryland Geological Survey's Miocene volume, 1904.

The line marking the inner limit of the Calvert, the basal formation, crosses Maryland and extends into Virginia nearly to, if not to, Peters-

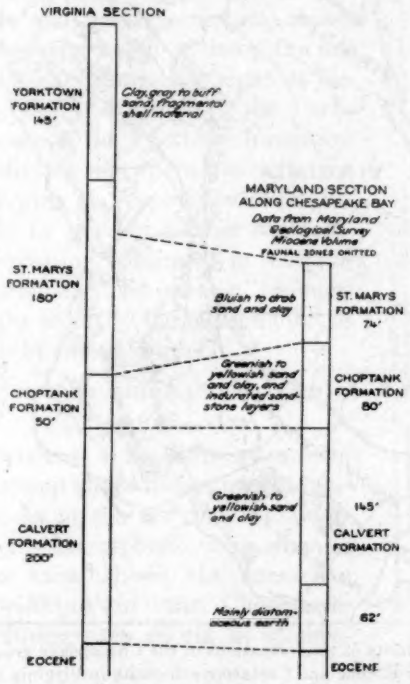


Figure 1.—Columnar sections of the Miocene of Maryland and Virginia.

burg, on the Appomattox River; that of the Choptank formation crosses Maryland but extends only about as far as Rappahannock River in Virginia; that of the St. Marys formation nearly parallels the Choptank boundary in Maryland and extends to the Nottoway River in southern Virginia and perhaps farther south; and that of the Yorktown begins near the Rappahannock River, Va., and extends much farther south in Virginia and North Carolina than the other formations.

The distribution of the formations of the group in Virginia shows that the St. Marys formation overlaps the Choptank and Calvert formations to the south and that the Yorktown formation transgresses westward over all other formations of the Coastal Plain and laps over a few miles on the crystalline rocks which underlie the eastern portion of the Piedmont Plateau.

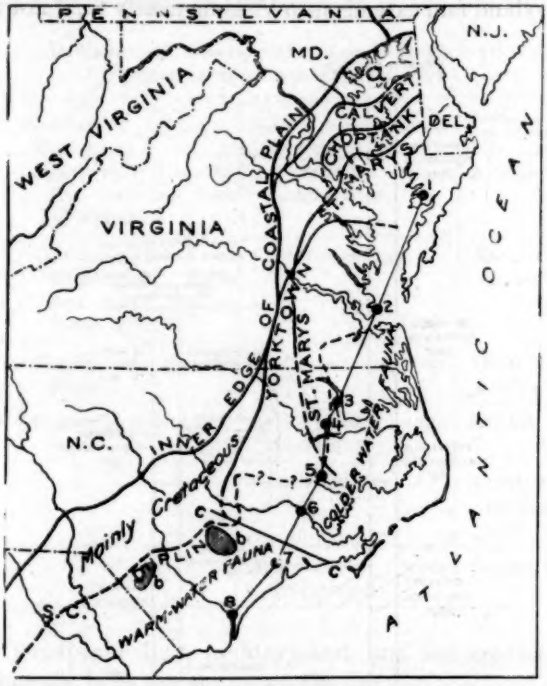


Figure 2.—Inner limits of the formations of the Chesapeake group and Duplin marl. *a* = area occupied by Eocene and Cretaceous deposits in Virginia and Maryland. *b* = westernmost patches of Duplin marl in North Carolina. *c* – *c* = line separating late Miocene beds with "colder-water fauna" from those with "warmer-water fauna." Numbered line indicates location of section shown in Figure 3.

The credit for the first recognition of the great western transgression of the Yorktown sea, as now interpreted by me, belongs to Dr. A. A. Olsson,[5] whose "Murfreesboro stage," recognized on the Meherrin River at and near Murfreesboro, N. C., and at Petersburg and along James River, Va., and elsewhere, belongs in reality to the lower part

[5] A. A. Olsson. Bull. Am. Paleont. Soc. 5: 155–163. 1917.

of the Yorktown formation. The name "Murfreesboro" is preoccupied for a Paleozoic formation in Tennessee.

SECTION FROM CRISFIELD, MD., TO WILMINGTON, N. C.

A section (Fig. 3) drawn from Crisfield, Md., to Wilmington, N. C. (see trace of section on map, Fig. 2) somewhat hypothetical but checked by well records and geologic reports, shows that the down-warping which initiated the deposition of the Chesapeake group began at the north and progressed southward to the Carolinas. The absence of the Yorktown formation in Maryland indicates that there was sufficient uplift there following the deposition of the St. Marys formation to prevent further sedimentation while deposition continued in Virginia and North Carolina. The section becomes thinner toward the south by the pinching out of formations older than the Yorktown.

CLIMATIC CONDITIONS INDICATED BY THE FAUNAS

The molluscan faunas of the different zones of the Chesapeake group afford indications of temperature conditions in the sea and, by inference, of adjacent atmospheric and climatic conditions. The table shows the successive temperature conditions in the Chesapeake Miocene basin during each epoch, as at present interpreted.

Duplin Marl

The Duplin marl, a richly fossiliferous formation which occurs in small patches in southern North Carolina and elsewhere farther south, appears to be of nearly the same age as the upper part of the Yorktown formation as developed around Suffolk, Va. This opinion of simultaneously existing faunas was also suggested by Dall.[6]

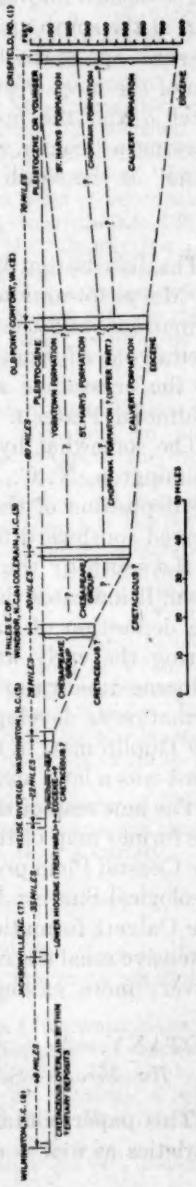


Figure 3.—Section from Crisfield, Md., to Wilmington, N. C., showing the thinning out of the Chesapeake group southward.

[6] W. H. Dall. *The relations of the Miocene of Maryland to that of other regions and to the Recent fauna.* Md. Geol. Surv., Miocene, p. exliv. 1904

The dashed line on Figure 2 indicates the western limit of the Duplin marl at the south and of beds of the upper Yorktown of approximately the same age as the Duplin at the north. On the same figure (Fig. 2), two of the most westerly patches of the Duplin marl are indicated by letter *b* and the approximate separation of the late Miocene beds carrying a "colder water fauna" at the north and a "warmer water fauna" at the south by the line *c-c*.

Conclusions

The distribution of the formations in Virginia seems to show that the St. Marys formation at the south overlaps the Choptank and Calvert formations, and that the Yorktown formation transgresses westward over all older formations of the Coastal Plain and laps over a few miles on the crystalline rocks which underlie the eastern border of the Piedmond Plateau.

The somewhat hypothetical section drawn from Crisfield, Md., to Wilmington, N. C., indicates that the down-warping which initiated the deposition of the Chesapeake group began at the north and progressed southward to the Carolinas. As the section becomes thinner at the south by the pinching out of formations older than the Yorktown, it indicates that the more northern area constituted a basin for the deposition of the sediments of the Chesapeake group, and that during the early and middle Miocene time and during the upper Miocene time prior to the deposition of the beds of the Yorktown formation as developed around Suffolk, Va., the area now occupied by the Duplin marl in the Cape Fear region practically as far out as the coast was a land area undergoing erosion.

The new map of the Chesapeake group of Virginia, as compared with the former map of the State based on the work of Clark and Miller on the Coastal Plain province of Virginia, published as Bulletin 4, Virginia Geological Survey, 1912, shows, in general: Less areal distribution of the Calvert formation; the presence of the Choptank formation; less extensive areal distribution of the St. Marys formation south of James River; more extensive areal distribution of Yorktown formation.

BOTANY.—*New Asteraceae from the United States, Mexico, and Honduras.*[1] S. F. Blake, Bureau of Plant Industry.

This paper contains descriptions of eight new species and several varieties as well as reallocations of several species already described.

Solidago wrightii A. Gray, Proc. Amer. Acad. **16**: 80. 1880.
Solidago bigelovii A. Gray, (Proc. Amer. Acad. **16**: 80. 1880, nomen nudum;) Proc. Amer. Acad. **17**: 190. 1882.

[1] Received April 16, 1929.

Solidago bigelovii var. *wrightii* A. Gray, Proc. Amer. Acad. 17: 190. 1882.

The name *Solidago bigelovii*, in use for many years for a southwestern goldenrod, must give place to *S. wrightii*. Both names first appeared in 1880, *S. bigelovii* having precedence on the page but not being provided with description, while *S. wrightii* was fully described. The treatment of *S. bigelovii* at this place is as follows: "S. BIGELOVII is a New Mexican species founded on *S. petiolaris*, var., Gray in Bot. Mex. Bound. 79, collected by Bigelow, Wright, and Parry, and placed next to *S. Lindheimeriana* of Scheele, which was in Pl. Lindh. referred to *S. speciosa*, var. *rigidiuscula*." On p. 79 of the Botany of the Mexican Boundary there is no word of description; hence the species dates from its first publication with description in 1882.

Solidago wrightii was properly published in 1880, with description and reference to two synonyms,[2] as well as citation of range and collectors ("W. Texas to Arizona, Wright, Bigelow, Rothrock"). From the name given and the first cited reference and collector it is evident that *Wright* 281, the plant on which the mention in "Plantae Wrightianae" was based, is properly to be taken as type of the species. The specimen of this number in the U. S. National Herbarium (collected on "mountains between the Limpia and the Rio Grande," Texas) is rather slender, about 35 cm. high, simple below the inflorescence, with elliptic middle leaves about 3.5 cm. long and 1 cm. wide, and heads in small cymes of 2 to 4 at tips of the erectish branches, the whole forming a 12-headed cymose panicle about 7 cm. wide. *Solidago "bigelovii"* is variable in inflorescence, the heads being sometimes very few and clustered, sometimes numerous and thyrsoid on the stem and branches, but the differences appear to be purely individual and of no taxonomic or geographic significance, and I find no grounds for distinguishing *S. wrightii* from *S. bigelovii*, either varietally, as by Gray, or specifically, as by Wooton and Standley in their "Flora of New Mexico."

The only specimen examined from Texas is *Wright* 281, the type. *Solidago bigelovii* was included by the writer in Tidestrom's "Flora of Utah and Nevada,"[3] on the basis of a specimen in the U. S. National Herbarium originally labelled "Solidago remoralis, Ait. var. Nevada. Wheeler Exp. 1872." As all the Arizona specimens examined are from the southeastern part of the State, it seems probable that the species does not range so far north, and that this specimen is mislabeled as to locality.

A remarkable form with many or most of the hairs gland-tipped occurs in Arizona and New Mexico; although very distinct in its extreme, too closely connected by intermediate specimens to rank as more than a variety.

Solidago wrightii var. **adenophora** Blake, var. nov.

(?) *Solidago subviscosa* Greene, Pittonia **3**: 348. 1898.

Habit, foliage, and inflorescence as in the typical form, and similarly variable; involucre, sometimes also the pedicels, leaves, and stem, glandular-puberulous.

ARIZONA: Between Bar-foot fire station and Paradise, Chiricahua National Forest, Cochise County, alt. 2200–2400 m., 22–23 Sept. 1914, *Eggleston* 10833, 10867 in part. Rincon Mountains, 1891, *Neally* 205. Mt. Graham, alt. 2745 m., Sept. 1874, *Rothrock* 730. Mt. Lemmon, alt. 2285 m., 4 Sept. 1926, *G. J. Harrison* 3016 (type no. 1,285,413, U. S. Nat. Herb.) NEW

[2] *S. petiolaris* var., A. Gray, Pl. Wright. **1**: 94. 1852; *S. californica* var., Rothrock in Wheeler, Rep. U. S. Surv. 100th Merid. **6**: 145. 1878.

[3] Contr. U. S. Nat. Herb. **25**: 539. 1925.

MEXICO: Near Gray, Lincoln County, alt. 1830 m., July 1898, *Skehan* 70. In pine belt, El Capitan Mountains, alt. 2135 m., 28 July 1900, *Earle* 489. Copper Canyon, Magdalena Mountains, alt. 2805 m., 3 Sept. 1909, *Goldman* 1673. Tularosa Creek, Sacramento Mountains, Otero County, 18 Aug. 1899, *Wooton*. Pecos River, alt. 2135 m., 23 Aug. 1903, *Bailey* 550.

When practically all the hairs are gland-tipped, as they are in the type, the difference between this plant and typical *S. wrightii* with its grayish puberulence of spreading (rarely incurved) hairs seems too great to be merely varietal. In most of the specimens cited, however, the glandularity is confined to the involucre, and it is evident that no specific line can be drawn. In the genus as a whole the presence of glandular hairs is of rare occurrence. The description of *Solidago subviscosa* Greene is strongly suggestive of this plant, but in the absence of the type specimen (Chiricahua Mountains, 15 Sept. 1896, *Toumey*) its identity is uncertain. It was said by Greene to combine some of the characteristics of *S. bigelovii* and *S. parryi*, and the description applies about as well as some specimens of *S. parryi*.

Acamptopappus sphaerocephalus var. **hirtellus** Blake, var. nov.

Stems and leaves more or less densely hirtellous; leaves often relatively shorter and wider than in the typical form.

CALIFORNIA: Near Lone Pine, Inyo Co., alt. 1150 m., 7 June 1891, *F. V. Coville & F. Funston* 890 (type no. 1,203,074, U. S. Nat. Herb.); Randsburg to Rand, *K. Brandegee;* Mojave, *Eastwood* 3184; Willow Springs, *F. Grinnell* 427,443; Antelope Valley, *Grinnell;* Lancaster, *Elmer* 3621, *Hall & Chandler* 7388 (non-typical); Palmdale, *Abrams & McGregor* 513; Kramer, *K. Brandegee;* Barstow, *Jepson* 5835; desert near Hesperia, alt. 975 m., *Blake* 9885; Mohave Desert, *Parish* 139, *Pringle* (24 May 1882), *Purpus* 5443; without definite locality, 1876, *Palmer* 219.

Acamptopappus sphaerocephalus (Harv. & Gray) A. Gray can be divided readily into two varieties with definite characters and definite geographical range. The plant growing in southern Utah, western Arizona, extreme southwestern Nevada (*Goodding* 1423, from Bunkerville, which is in Nevada, not Utah as printed on the label), and the Colorado Desert region has glabrous stems and branches, and the leaves are glabrous or hispidulous-ciliolate. This is the typical form, originally described, under the name *Aplopappus sphaerocephalus* Harv. & Gray, as "fruticosa ? glabra." The type was collected by Thomas Coulter in "California." The other form (var. *hirtellus*) with hirtellous stem, branches, and leaves, ranges from Antelope Valley, in the western part of the Mohave Desert, east to Kramer and north to Lone Pine, Inyo County.

Acamptopappus microcephalus Jones, the description of which suggests the variety here described, is shown by the type collection to be *Aplopappus cooperi* (A. Gray) Hall.

Erigeron inornatus forma **subradiatus** Blake, forma nov.

Heads with about 7–11 pale yellow imperfectly developed rays 6.5–7 mm. long (tube 1.5–1.8 mm., throat 2–3.2 mm., lamina elliptic, concave, spreading,

usually 3-denticulate, 2.2–3.3 mm. long), pistillate and bearing 3–5 abortive and separated stamens.

CALIFORNIA: Along path in dry woods, Tahoe Tavern, Eldorado County, alt. 1900 m., 15 Aug. 1927, *S. F. Blake* 10302 (type no. 1,436,302, U. S. Nat. Herb.).

Erigeron inornatus A. Gray is one of several western species of *Erigeron* which have hitherto been supposed to have always discoid heads. The present plant, a colony of which I found growing in company with discoid plants (no. 10301) near the shore of Lake Tahoe, is consequently of considerable interest. Both the subradiate and discoid plants found here represent the var. *viscidulus* A. Gray rather than the typical glabrous form of *E. inornatus*, having the stem (short-hirsute below) and leaves hirsutulous and the involucre evidently glandular.

Lessingia leptoclada var. **arachnoidea** (Greene) Blake.

Lessingia arachnoidea Greene, Leaflets **2**: 29. 1910.

This variety, characterized by its very short pappus (only 1–1.5 mm. long, that of the typical form being 3.5–6 mm. long), is known only from the vicinity of Crystal Springs Lake, San Mateo County, California, where it occurs to the exclusion of typical *L. leptoclada* A. Gray.

Archibaccharis standleyi Blake, sp. nov.

Erect, suffrutescent; stem subsimple, somewhat zigzag, leafy, densely and finely puberulous with several-celled, conical, spreading or incurved, brownish hairs; leaves ovate, acuminate, rounded at base, short-petioled, chartaceous, mucronulate-serrulate, finely hispidulous, scabrid above, gland-dotted beneath; staminate heads 4–5 mm. high, slender-pediceled, in small panicles at tip of stem and the few branches, 9–20-flowered.

Stem 35 cm.–1 m. high, 1–3 mm. thick, subterete or somewhat round-angled; internodes 8–15 mm. long; leaves alternate; petioles naked, 1.5–3 mm. long; blades ovate or lance-ovate, 2–5.5 cm. long, 1–2.5 cm. wide (smaller toward base of stem), acuminate, somewhat falcate, apiculate (apiculus 0.8–1.5 mm. long), at base rounded or subcordate, near middle mucronulate-serrulate or shallowly crenate-serrate (teeth about 6 pairs, very depressed, 2–6 mm. apart, the curved callous mucros about 0.5 mm. long), firmly chartaceous, above rather densely antrorse-hispidulous, beneath slightly lighter green, similarly but less densely and more softly hispidulous and rather densely gland-dotted, feather-veined and prominulous-reticulate on both sides, the chief lateral veins 4–5 pairs, sometimes impressed above, prominent beneath; heads about 6–10, in convex panicles 2–4 cm. wide, the filiform straightish pedicels 5–10 mm. long, puberulous like the stem, the bracts of inflorescence minute, linear-subulate, mostly 2 mm. long or less; involucre campanulate, 4–6-seriate, 3 mm. high, the phyllaries lanceolate to lance-linear, acuminate, with greenish center and narrow scarious margin, often purplish-tipped, erect, rather densely antrorse-puberulous and gland-dotted; pistillate flowers 2–5, their corollas whitish, sparsely pubescent with somewhat clavate hairs, 4 mm. long (tube 3–3.3 mm. long, ligule erect, concave, minutely 2–3-denticulate, 0.7–1 mm. long), much shorter than style, the achenes (immature) hispidulous, 1 mm. long, the pappus whitish, 4 mm. long, the bristles finely hispidulous-denticulate, not clavate; hermaphrodite flowers 7–15, their corollas whitish, puberulous, 5.2 mm. long (tube 2.2 mm., throat essentially absent, teeth linear, acute 3 mm. long), the achenes hispidulous,

1 mm. long, the pappus whitish, 4.5 mm. long, the bristles denticulate-hispidulous, slightly clavellate at apex; style branches oblong, acute, finely hispidulous, erect, 0.8 mm. long.

HONDURAS: Open rocky or brushy banks, vicinity of Siguatepeque, Dept. Comayagua, alt. 1080–1400 m., 14–27 Feb. 1928, *P. C. Standley* 56193 (type no. 1,308,936, U. S. Nat. Herb.), 56356.

This species, of which only the staminate plant is known, is nearest *Archibaccharis hirtella* (DC.) Heering, differing from that species in its erect (not scandent) habit, the very fine and dense puberulence of the stem, the much firmer leaves, and the slightly larger heads. In its combination of erect habit with definitely zigzag stem and small panicles it to some extent breaks down the distinctive characters of the two principal groups into which the small-headed species of the genus are divided.

Trigonospermum hispidulum Blake, sp. nov.

Herb, apparently unbranched, the stem rather densely hispidulous with several-celled, spreading, conical, acute hairs; leaf blades rhombic-ovate, unequally callous-dentate and -denticulate, somewhat hastately so near the basal angle, lepidote-tuberculate-hispidulous above, hispidulous with antrorse hairs beneath, cuneate-decurrent on upper part of petiole; heads small, numerous, in a somewhat rounded panicle; lamina of rays 4–4.5 mm. long.

Stem more than 60 cm. high, purplish brown, below subterete, striatulate, and 4 mm. thick, above sulcate; internodes about 9–11 cm. long; leaves opposite; petioles incurved-pubescent and with longer spreading several-celled hairs, the unmargined part 1.5–2 cm. long, broadened at base and shallowly connate; blades 8.5–11 cm. long (including margined portion of petiole, this 1.5–4 cm. long) 4.5–6.5 cm. wide, acute, often short-pointed, at base broadly cuneate-rounded and abruptly cuneate-decurrent on petiole, rather thin, dark dull green and in age lepidote-tuberculate above, scarcely paler and gland-dotted beneath, triplinerved from base of proper blade, prominulous-reticulate especially beneath; panicle 11 cm. wide, the ascending lower branches about 8 cm. long, densely spreading-hispidulous and with sparser stipitate yellowish glands, the pedicels 4 mm. long or less; involucre 2-seriate, subequal, 3 mm. high, the outer phyllaries 5, subherbaceous, oblong or ovate-oblong, obtusely callous-tipped, 3-nerved, the inner broader and thinner, ovate, acute or acuminate, all yellowish green, finely and rather densely hispidulous and ciliolate; rays 7, golden, fertile, hispidulous and stipitate-glandular on tube and back, the tube 0.7 mm. long, the lamina quadrate-cuneate, 3-lobed nearly to middle, 4–4.5 mm. long and wide, 9–11-nerved; disk flowers about 26, their corollas 5-toothed, golden, pilose with several-celled hairs and somewhat glandular, 3 mm. long (tube 0.8 mm., throat funnelform-campanulate, 1.7 mm. long, teeth ovate, 0.5 mm. long, papillate especially near margin within); pales lanceolate to linear, acute, ciliate, about 1.5 mm. long; immature ray achenes obovoid, obcompressed, glabrous, 1.3 mm. long; ovaries of disk glabrous; style of disk short-hispid, barely bifid.

MEXICO: On streambank, Hacienda de Ototal, Arroyo de Ototal, west of San Sebastian, Sierra Madre Occidental, Jalisco, alt. 1500 m., 9 March 1927, *Ynez Mexia* 1852 (type no. 1,318,113, U. S. Nat. Herb.).

Allied to *Trigonospermum floribundum* Greenm., in which the stem is more or less densely pilosulous and usually provided with rather dense,

dark, stipitate glands, the leaves rather evenly dentate or denticulate without tendency to hastation, and rays 6–9 mm. long. Only a single plant found.

Echinacea laevigata (Boynton & Beadle) Blake.

Brauneria laevigata Boynton & Beadle in Small, Fl. S. E. U. S. 1261, 1340. 1903.

This species is apparently still known only from the original specimens in the United States National Herbarium collected near Seneca, western South Carolina, in June 1888, by Gerald McCarthy.

Echinacea angustifolia var. **tennesseensis** (Beadle) Blake.

Brauneria tennesseensis Beadle, Bot. Gaz. **25**: 359. 1898.

In the original description this plant was compared only with *Brauneria pallida* (Nutt.) Britton (= *Echinacea pallida* Nutt.). It is much nearer *Echinacea angustifolia* DC., differing in its generally smaller size, narrower only 1–3-nerved leaves, and spreading-hispid stems and leaves (especially the margins and petioles), but as it intergrades in all these characters it is best considered a variety of that species.

Verbesina microcarpa Blake, sp. nov.

Shrub; stem pubescent; leaves alternate, ovate, acuminate at each end, serrate, rough above with tuberculate-based hairs, beneath griseous-subtomentose, the naked portion of petiole 6–12 mm. long; heads rather small, in an irregular concave cymose panicle, on pedicels mostly twice their length; involucre about 3 mm. high, the oblong-ovate pilosulous phyllaries with reflexed tips; pales spreading-cuspidate; lamina of rays about 7 mm. long.

"Bushy shrub, 2.5 m. high;" branches simple, terete, striatulate, brownish, densely pilose with several-celled, curved, spreading-ascending hairs, these in age mostly deciduous except for the subtuberculate bases; internodes 2.5–4.5 cm. long, wingless; peticles exauriculate, pubescent like the stem; blades 8–11.5 cm. long, 3–4 cm. wide, acuminate, slightly falcate, rounded toward base and then cuneately decurrent on the petiole for 1.5–2 cm., serrate above the entire base with 15–18 pairs of depressed bluntly callous-apiculate teeth, papery, above green, evenly but not densely hirsutulous with antrorse-curved hairs with small tuberculate bases, beneath when young canescently silky-pilose, at maturity uniformly and densely subtomentose-pilose with antrorse-curved hairs, feather-veined (lateral veins 7–9 pairs, prominulous on both sides, the secondaries obsolete); heads about 2 cm. wide, in cymes of about 3 at tips of stem and subterminal branches, forming a convex panicle of about 20 heads, about 11 cm. wide, the pedicels of the terminal heads short, about 5 mm. long, of the lateral 1–2 cm. long, pubescent like the stem, the bracts linear or lance-linear, 1.5 cm. long or less; disk subglobose, 1 cm. thick in mature flower; involucre 2-seriate, 3–4 mm. high, subequal, the outer phyllaries about 5, ovate-oblong, 2 mm. wide, greenish-stramineous, with more herbaceous tips, apiculate, the inner similar to the pales, with reflexed cusps; receptacle small, convex; rays about 10, "lemon-yellow," fertile, the tube pilosulous, 1.5 mm. long, the lamina elliptic, 7 mm. long, 3–3.8 mm. wide, 3-denticulate, 6–8-nerved; disk corollas numerous, "lemon-yellow," pilosulous on tube and base of throat, about 3.4 mm. long (tube 0.6–0.8 mm. long, throat funnelform-campanulate, 1.6–1.8 mm. long, teeth ovate, 1 mm. long, ciliolate on inner margin with long papillae); pales boat-shaped, firm, whitish, hirsutulous above, 4 mm. long, terminated by spreading cusps

about 0.8 mm. long; disk achenes 2.2 mm. long, 1.5–1.8 mm. wide (including wings), the body blackish, tuberculate-hispidulous above, 1.8–2 mm. long, 1–1.2 mm. wide, the wings ciliolate, adnate to base of awns, 0.3–0.5 mm. wide; awns 2, subequal, 1.4 mm. long.

MEXICO: Open oak and pine forest, trail from El Batel to Pico del Aguila, Sierra Madre, Sinaloa, alt. 1220 m., 14 Nov. 1925, *Ynez Mexia* 459 (type no. 141815, herb. Calif. Acad. Sci.; photogr. and fragm., U. S. Nat. Herb.).

A species of the section *Saubinetia*, without striking characters, yet clearly distinct from related species. Of these, *V. seemannii* Sch. Bip. has much narrower leaves (blade about 14 cm. long and 2.5 cm. wide or less), these merely hirsutulous on costa and chief veins beneath, and the shorter involucre is nearly glabrous; *V. liebmannii* Sch. Bip., which vacillates between the sections *Verbesinaria* and *Saubinetia*, has leaves very much less pubescent beneath; *V. cinerascens* Robins. & Greenm. has much narrower leaves with much finer pubescence beneath; and *V. olivacea* Klatt, while similar in pubescence of lower leaf surface, has considerably larger heads and larger involucre.

Zexmenia melastomacea Blake, sp. nov.

Suffrutescent; stem spreading-hispid or -hirsute; leaves ovate, acute, rounded at base, serrulate, short-petioled, harsh-pubescent above, more densely pubescent beneath, 3–5-plinerved, impressed-veined and more or less bullate above, prominulous-reticulate beneath; heads radiate, golden yellow, medium-sized, 1–4 at tips of stem and branches, on peduncles usually 1.5 cm. long or less, occasionally to 3.5 cm.; involucre about 3-seriate, 7–9 mm. high, the phyllaries mostly oblong, densely strigose, with squarrose deltoid herbaceous tips; achenes neither winged nor definitely margined, their pappus of 2 or 3 awns, and 2–7 squamellae about 1 mm. long.

Erect, about 0.5–1 m. high, with erectish or divergent branches; stem gray-barked below and 4 mm. thick, subangulate, densely or sometimes rather sparsely spreading-hispid or hirsute, particularly at the nodes, with several-celled whitish hairs up to 2.5 mm. long; internodes 3.5–12 cm. long; leaves opposite; petioles naked, sulcate above, hispid or hirsute and hispidulous, 3–7 mm. long; blades ovate or broadly ovate, or the smaller ones suborbicular, 3–6.5 cm. long, 1.5–3.8 cm. wide, mucronulate-serrulate except toward base and apex with 5–8 pairs of small teeth, above hispid and hispidulous with tuberculate-based hairs, beneath paler green or griseous, densely strigose, strigose-hispid, or rather softly hispid-hirsute (the hairs longer along the veins); peduncles stoutish, strigose or antrorse-hirsute, usually shorter than the subtending leaves; involucre campanulate, the phyllaries oblong or oblong-ovate, 2–3.5 mm. wide, the body indurated-subherbaceous, the deltoid acutish tips (2–3 mm. long) squarrose except in the inmost phyllaries, these with subscarious ciliolate but otherwise glabrous purplish margin below; rays about 8, pistillate, the tube glabrous, 2.5 mm. long, the lamina oval, about 12 mm. long, 7 mm. wide, 2-denticulate, about 18-nerved, hirsute and hirsutulous on back; disk flowers rather numerous, their corollas glabrous except for the appressed-hirsutulous, papillose-margined teeth, 7.3 mm. long (tube 2 mm., throat cylindric-funnelform, 3.5 mm., teeth ovate, 1.8 mm.); pales firm, acute, purplish above, finely ciliolate, on back above stigillose and sparsely hispid, about 10 mm. long; ray achenes trigonous, not winged,

hispidulous, 5 mm. long, their pappus of 3 lanceolate trigonous ciliolate awns 2–3.8 mm. long and about 4–7 basally united, oblong or triangular, ciliolate squamellae 1–1.5 mm. long; disk achenes cuneate-oblong, 4-angled, 4.3 mm. long, 1.3 mm. wide, tuberculate-hispidulous, their pappus of 2 unequal hispidulous-ciliolate awns 2.5–4.2 mm. long, and 2 broad ciliolate squamellae 1 mm. long; style branches linear, somewhat enlarged toward the tip of the stigmatic region and there dorsally hirsute, the linear appendages 1 mm. long, hispidulous above.

HONDURAS: In pine forests, vicinity of Siguatepeque, Dept. Comayagua, alt. 1080–1400 m., 14–27 Feb. 1928, *P. C. Standley* 56389 (type no. 1,308,960, U. S. Nat. Herb.), 55826.

Nearest *Zexmenia michoacana* Blake, but quite distinct in involucral and other characters. The two collections referred here differ in density or at least in degree of persistence of stem pubescence and in density and character of leaf pubescence, but undoubtedly represent a single species.

Coreopsis congregata Blake sp. nov.

Low, slender, erect, nearly simple, sparsely pubescent annual; leaves opposite, nearly uniform, shorter than internodes, short-petioled, once or twice pinnatifid, with mostly oblong or ovate lobes; heads small, few, yellow; phyllaries pilose; rays neutral, inner disk flowers apparently infertile; outer disk achenes small, obovoid-meniscoid, with narrow, thick, incurved, lobed, crustaceous margin; pappus none.

Stem 13–32 cm. high, whitish, sulcate-striate, sparsely pilose especially above with chiefly ascending hairs; internodes 2–5 cm. long; leaves about 5 pairs, the lower (shrivelled) about 3 cm. long (including petiole, this about 0.7 cm. long), pilose especially on petiole (the hairs there longer and flatter), apparently bipinnatifid; the middle and upper short-petioled or subsessile, triangular in outline, 1.8–3.5 cm. long, 1.2–2 cm. wide, acute, cuneate-rounded at base, deeply pinnatifid with 2–4 pairs of lobes, these oblong to ovate or lance-ovate, acute or obtuse, callous-mucronulate, the lowest pair nearly separate from the others and entire or similarly pinnatifid, all thin, green and pilose on both sides; heads 1–7 per stem, solitary or in 2's or 3's from the axils of reduced leaves at tip of stem and the few erect branches, 2 cm. wide or less; peduncles very slender, naked or with 1–2 very small bracts, 2–5 cm. long, pubescent like the stem; disk about 5 mm. high and thick; involucre double, reflexed in age, the outer phyllaries 8, thin, herbaceous, narrowly spatulate to linear, obtusely callous-tipped, 2.5–3.5 mm. long, about 0.7 mm. wide, 3-nerved (the middle nerve stronger and darkened), pilose and ciliate with several-celled hairs; inner phyllaries membranous, elliptic-oblong, 4.5–4.8 mm. long, about 1.8 mm. wide, obtusely pointed, golden-yellow, sparsely pilose on back, ciliolate at apex, 5–7-nerved; receptacle small, flattish; rays 8, golden yellow, neutral, the tube about 0.7 mm. long, stipitate-glandular, the lamina elliptic-oblong, subentire, 5-nerved, 5.5–6.5 mm. long, 2.5–2.8 mm. wide; disk flowers 15 or more, their corollas golden yellow, stipitate-glandular on tube, papillate on inner margin of teeth, 2.5–2.8 mm. long (tube 0.7–1 mm., throat campanulate, 1.5 mm., teeth deltoid, 0.3–0.5 mm.); pales linear, acutish or obtuse, glabrous, yellow, about 4-vittate, about 3.5 mm. long; outer disk achenes slightly depressed at apex, 2–2.3 mm. long, 1.3–1.5 mm. wide, glabrous, dark brownish or mottled, on outer face smooth or slightly blunt-muricate above, on inner face calloused at base, 1-ridged

and crustaceous-mamillate, the thickened brownish margin (about 0.3 mm. wide) longitudinally rugulose, sinuate below, above divided into a few rounded lobes; inner disk achenes slender, about 2.2 mm. long, with small imperfectly developed embryo; style branches broadened and dorsally hispid above, passing into a papillate cusp 0.2 mm. long.

MEXICO: Common, growing in masses, in damp places in openings in oak and pine forests, trail from El Batel to Pica del Aguila, Sierra Madre, Sinaloa, alt. 1220 m., 14 Nov. 1925, *Ynez Mexia* 445 (type in Gray Herb.; photogr. and fragm., U. S. Nat. Herb.).

A species belonging to the section *Leachia*, without any very close ally.

Plummera ambigens Blake, sp. nov.

Ray achenes villous with straight hairs, and with a pappus of about 6 unequal, oblong, obtuse, lacerate, ribless, hyaline squamellae about 1 mm. long; disk achenes usually trigonous, thicker than in *P. floribunda*, with evident but imperfect ovule, villous with straight hairs and with a pappus of about 4 or 5 unequal, oblong or lanceolate, obtuse to acuminate, lacerate, ribless hyaline squamellae 0.5–1.3 mm. long; style branches of disk with stigmatic lines; otherwise as in *P. floribunda* A. Gray.

ARIZONA: Fairly common on lower slopes of Mt. Graham, about 1370 m. alt., 22 July 1927, *R. H. Peebles, T. H. Kearney, & G. J. Harrison* 4395 (type no. 1,436,073, U. S. Nat. Herb.).

Plummera floribunda A. Gray, the only member of the genus hitherto known, is one of the rarest of United States Asteraceae in herbaria. In it both the ray and disk achenes are completely without pappus and are loosely villous with flexuous hairs, the disk achenes are stipitiform and without trace of embryo, and the style branches of the disk lack any trace of stigmatic lines. Aside from the achenes, pappus, and style branches *P. ambigens* is so precisely similar to *P. floribunda* that I have been unable to find any distinctive characters. The pedicels and young tips are more hairy—essentially cinereous-tomentose—than in the two collections of *P. floribunda* available for comparison, and the inner phyllaries more strongly ciliate and more abruptly cuspidate, but these slight differences are not likely to prove constant when more material is examined. The differences between the somewhat more obovoid ray achene of *P. floribunda*, with its rather definite stipitiform base or carpopod, and that of *P. ambigens* are probably due to the greater maturity of the former. The presence of a well developed pappus in *P. ambigens* and and the tendency toward fertility of the disk flowers, however, not only sharply differentiate the new plant from *P. floribunda* but tend to break down the gap between the section of *Actinea* often separated as a distinct genus *Hymenoxys* and the hitherto well distinguished genus *Plummera*.

Plummera was placed by Gray[4] in the Helianthoideae-Millerieae, although he recognized[5] that "the natural affinity of this plant may rather be with Actinella [= Actinea] in the Helenioideae." O. Hoffmann[6] put it in the

[4] Syn. Fl. 1^2: 59, 237. 1884.
[5] Proc. Amer. Acad. 17: 215. 1882.
[6] In Engler & Prantl, Nat. Pflanzenfam. 4^3: 263. 1890.

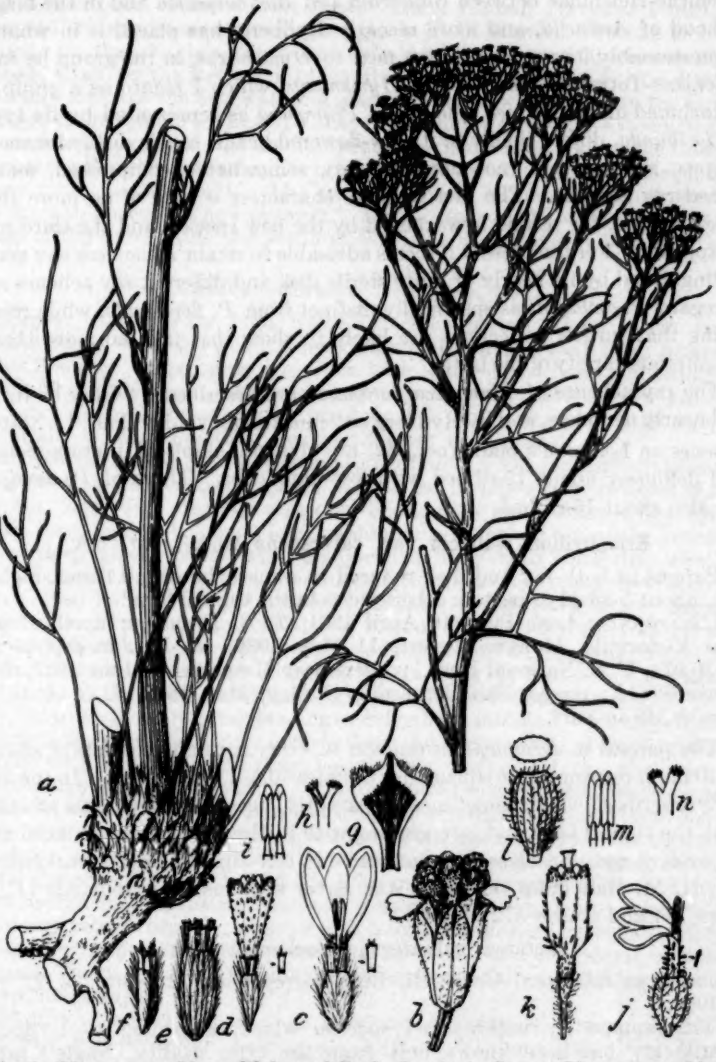


Fig. 1. *Plummera ambigens* Blake and *P. floribunda* A. Gray.—*Plummera ambigens* (a-i): a, plant ×½; b, head, ×5; c, ray flower, ×5; d, disk flower, ×5; e, ray achene, ×5; f, disk achene, ×5; g, inner phyllary, ×5; h, style branches, ×7; i, stamens, ×5; *Plummera floribunda*: j, ray flower, ×5; k, disk flower, ×5; l, ray achene, × 5; m, stamens, ×5; n, style branches, ×7.

Helenieae-Heleninae between *Gaillardia* and *Blennosperma* and in the neighborhood of *Actinella*, and more recently Rydberg[7] has placed it in what is unquestionably its proper position next to *Hymenoxys*, in the group he calls Helenieae-Tetraneuranae. From *Hymenoxys*, which I regard as a group to be included under *Actinea*, the genus *Plummera* as represented by its type, *P. floribunda*, differs chiefly in its few-flowered heads, sterile disk, absence of pappus, and obovoid (not obpyramidal), somewhat obcompressed, many-ribbed ray achenes. The first of these characters is here of no more than specific value, the second is weakened by the new species, and the third now disappears. For the present it seems advisable to retain *Plummera* as a genus distinguished by its nearly or quite sterile disk and different ray achenes and to regard *P. ambigens* as specifically distinct from *P. floribunda*, while recognizing that further collections are likely to show that it is no more than a pappiferous variety of the latter.

The ray achenes of *Plummera floribunda* are described by Gray as turgid and nearly nerveless, and by Rydberg as "cuneate-obovoid, villous." Mature achenes on Lemmon's plant (no. 352) are obovoid, elliptical in cross-section, and definitely about 15-ribbed with low blunt ribs. Those of *P. ambigens* are also about 15-ribbed.

Eriophyllum wallacei var. **calvescens** Blake, var. nov.

Pappus in both ray and disk reduced to a mere border, 0.1 mm. high or less, about 5-lobed or parted; otherwise as in the typical form.

CALIFORNIA: Lone Pine, 16 April 1891, *T. S. Brandege*; north of and near Victorville, Mohave Desert, 11 May 1926, *M. E. Jones* (type no. 1,436,074, U. S. National Herb.); desert near Hesperia, 14 June 1927, *S. F. Blake* 9881A; mesas, San Bernardino Valley, May 1882, *S. B. & W. F. Parish* 348 in part.

The pappus in *Eriophyllum wallacei* A. Gray normally consists of about 6 to 10 blunt opaque white squamellae or paleae 0.5–1.2 mm. long. In the form here described, which sometimes, apparently, occurs by itself and at others with the typical form and intergrading with it, the pappus is so reduced as to be evident only on close examination. It has already been mentioned by Dr. H. M. Hall[8] from the Santa Ana River bottoms near Redlands (*F. M. Reed* 784 and *Greata* 572 in part).

Actinea subintegra (Cockerell) Blake.

Hymenoxys subintegra Cockerell, Bull. Torrey Club **31**: 480. *pl.* 22, *f.* 1. 1904.

This apparently well-marked species, which, according to Rydberg's treatment,[9] has been known only from the type locality, Nagle's ranch, Arizona, was collected in the upper drainage of North Canyon, Kaibab National Forest, Coconino County, Arizona, altitude 2440 meters, 30 July 1926, by Leon W. Hornkohl (no. 35; specimen in Forest Service Herbarium).

[7] N. Amer. Fl. **34**: 118. 1915.
[8] Univ. Calif. Publ. Bot. **3**: 182. 1907.
[9] N. Amer. Fl. **34**: 116. 1915.

It has also been collected near Jacobs Lake, Kaibab National Forest, 14 August 1926 (specimens received through Dr. C. D. Marsh). Prof. M. E. Jones informs me that Nagle's Ranch, the type locality, is about 60 miles south of Kanab, Utah, on the west slope of the Buckskin Mountains (i.e., the Kaibab plateau), and was the first watering place on the old wagon road to the Grand Canyon from Kanab. The old Valley Tan ranch was about 15 miles further up on the plateau, and was the first ranch reached on the way to the Canyon after ascending the plateau. The present wagon road now ascends the plateau many miles farther north. The term Buckskin Mountains, as applied to the Kaibab Plateau, is now obsolete. Recent maps of the state show another range of the same name just south of Williams River (Bill Williams Fork).

Cacalia eriocarpa Blake, sp. nov.

Scapose, about 85 cm. high; leaves orbicular, peltate, about 14 cm. wide, hirsute-pilose, shallowly about 6-lobed, the lobes broader than long, repandly about 3-angled; scape spreading-pilose with many-celled hairs and stipitate-glandular; heads about 12-flowered, apparently erect, in a narrow panicle, on pedicels about 3 times as long; involucre 8–9 mm. high, sparsely pilosulous, essentially without bractlets; achenes densely silky-pilose.

Rootstock short and stout, bearing tufts of rusty wool, and clustered slender roots; well developed basal leaves 2, with an abortive one; petioles stout, 3–6 cm. long, very densely spreading-pilose with loose many-celled hairs; blades firm, peltate below middle, prominulous-reticulate especially beneath, above deep green, pilose with many-celled hairs with somewhat swollen bases, beneath lighter green, somewhat lucid, pilose on venation with loose many-celled hairs; scape subterete, striatulate, 4 mm. thick below, densely pilose toward base, sparsely so above, bearing 2 bracteiform leaves 1.5 cm. long or less, their blades tiny or none; panicle about 35 cm. long, about 28-headed, the slender erectish branches 11 cm. long or less, about 3-headed, subtended by linear bracts 9 mm. long or less; pedicels slender, mostly 2–3 cm. long, thickened toward head, bearing mostly above middle 3–6 minute erectish linear-subulate bracts 2 mm. long or less; involucre naked at base or occasionally with 1 approximate bract like those of the pedicel, the phyllaries 8, linear or lance-linear, 1.5–2 mm. wide, narrowed to an obtuse ciliolate apex, about 5–7-nerved, green or purplish on their exposed parts and there short-pilose with several-celled hairs especially toward apex, and sparsely stipitate-glandular, the inner with rather broad whitish subscarious margins; corollas white, glabrous, 9.2 mm. long (tube 4.2 mm., throat campanulate, 0.8 mm., teeth nearly linear, acutish, recurved, 3-nerved, 4.2 mm. long); achenes 3.8 mm. long; pappus copious, white, 8 mm. long, the minutely barbellate bristles united at extreme base, a few of the outer about 1.8 mm. long; style branches elongate, linear, recurved, hispidulous on back especially toward the rounded unappendaged apex.

MEXICO: Steep slopes in open pine and oak woods, Arroyo de Santa Gertrudis, San Sebastian, Jalisco, alt. 1500 m., 21 Jan. 1927, *Ynez Mexia* 1539 (type no. 1,406,195, U. S. Nat. Herb.).

A species of the group which Rydberg[10] recognizes as a distinct genus, *Psacalium* Cass. *Cacalia eriocarpa* is rather closely allied to *C. holwayana* Robinson (*Psacalium holwayanum* Rydb.), of which *P. langlassei* Rydb. is a

[10] Bull. Torrey Club **51**: 370-376. 1924.

synonym, as shown beyond. *Cacalia holwayana* is similar in habit, foliage, and pubescence to *C. eriocarpa*, but its heads are much larger (involucre 10–13 mm. long), normally strongly nodding, clustered or racemosely arranged toward tips of branches on much shorter pedicels, and the bractlets of the involucre or thickened tip of pedicel are conspicuous, linear-subulate, 4–9 mm. long.

Langlassé 576 is cited by Dr. Rydberg under both the first (*P. holwayanum*) and the last (*P. langlassei* Rydb., described as a new species) of his 14 species of *Psacalium*. Both come in his key in the group with strongly pubescent involucre, and are separated to this distance by the use of a character drawn from the "deeply cleft" or "sinuately lobed" leaves. Through the kindness of Dr. B. L. Robinson, it has been possible for me to compare the specimen in the National Herbarium (no. 386047) which is the type of *P. langlassei* with the specimen of the same number in the Gray Herbarium, which is apparently the one referred by Dr. Rydberg to *P. holwayanum*. The specimen in the National Herbarium differs from the one in the Gray Herbarium in its apparently erect heads and somewhat more shallowly lobed leaves (with sinuses 1–2 cm. deep; in the Gray Herbarium specimen 1.8–3.5 cm. deep), but their entire agreement in all other characters, including the very definite ones of involucre and achene, makes it certain that they represent the same species. The achenes of *P. holwayanum* are described by Dr. Rydberg as tomentulose, but are really densely short-hirsute with erectish or subappressed hairs.

Cacalia trigonophylla Blake, sp. nov.

Stem slender, from a tuberous root, few-leaved near middle, glabrous and glaucous throughout; lower leaves pentagonal, cordate, sharply 5-lobed, remotely callous-denticulate, the middle ones similar but trigonous, hastate-cordate, green above, strongly glaucous beneath, glabrous, all long-petioled, 4.5–6.5 cm. wide; heads 3–4, subracemose, discoid, about 29-flowered; involucre 8–9 mm. high, glabrous; bractlets about 1 mm. long.

Root about 1.5 cm. long, 0.9 cm. thick; stems apparently solitary, somewhat flexuous, 43–58 cm. high, about 6-leaved, whitish, more or less purplish-tinged and -lined; petioles unmargined, glabrous, 4–7.5 cm. long; leaf blades chartaceous, prominulous-reticulate above, less closely so beneath, repand between the lobes, 3.2–4.5 cm. long; the uppermost one or two much smaller, 3-lobed, 2.5 cm. wide or less; inflorescence about 9 cm. long, the slender peduncles 1-headed, 3–3.5 cm. long, minutely few-bracted, subtended by filiform bracts 5 mm. long or less; involucre thick-cylindric, subtended by about 10 linear acute fleshy bractlets 1.3 mm. long or less, the phyllaries 13, linear or lance-linear, 1–1.8 mm. wide, obtuse, ciliolate at apex, otherwise glabrous, thickened at base and along midline, greenish and glaucescent, with narrow subscarious whitish margins; corollas white, at maturity 10 mm. long, the tube 3.5 mm. long, the slender funnel-form throat 4 mm. long, the recoiled lance-linear acute teeth (1-nerved in middle) 2.5 mm. long; achenes oblong-prismatic, 10-ribbed, glabrous, 2.5 mm. long, about 1 mm. thick; pappus soft, white, about 7 mm. long, the bristles slightly thickened at apex, rather easily deciduous except for the extreme bases which form a minutely denticulate

collar at apex of achene; style branches truncate-rounded, of medium length, hispidulous on back, without obviously penicillate tip.

MEXICO: In dense growth beside stream on steep hillside, San Sebastian, trail to La Sabala Mine, Sierra Madre Occidental, Jalisco, alt. 1500 m., 10 Feb. 1927, *Ynez Mexia* 1656 (type no. 1,318,107, U. S. Nat. Herb.).

This species is a member of the group of the old genus *Cacalia* for which Dr. Rydberg has adopted the name *Pericalia* Cass. Its only close relative is *Cacalia michoacana* Robinson, a species of very similar habit but with the stem pilose from base to middle with many-celled, crisped hairs, the petioles and veins of the leaves similarly pubescent, the leaves all 5 (–7)-lobed and not glaucous beneath, and the bractlets of the involucre 3–6 mm. long.

ZOOLOGY.—*A new antelope squirrel from Lower California.*[1] E. W. NELSON and E. A. GOLDMAN, U. S. Biological Survey.

Recent field work in Lower California and the publication of the description of *Ammospermophilus leucurus canfieldae* by Laurence M. Huey,[2] Curator of Birds and Mammals, San Diego Society of Natural History, have contributed materially to knowledge of the antelope squirrels of the central part of the peninsula. Further study of these ground squirrels, which range the entire length of Lower California, has led to the segregation of a more southern subspecies described as follows:

Ammospermophilus leucurus extimus, subsp. nov.

Southern Peninsular Antelope Squirrel

Type.—From Saccaton, 15 miles north of Cape San Lucas, Lower California, Mexico. No. 146587, ♀ adult, U. S. National Museum (Biological Survey collection), collected by E. W. Nelson and E. A. Goldman, December 29, 1905. Original number, 18805.

Distribution.—Ranging from sea level to about 1,000 feet altitude on the slopes of the mountains from about latitude 28°; south to Cape San Lucas, except in Vizcaino Desert region.

General characters.—Most closely allied to *Ammospermophilus leucurus canfieldae*, but larger; color darker, usually with a near mikado brown (Ridgway, 1912) instead of vinaceous cinnamon suffusion; winter pelage shorter, thinner, more hispid; skull larger, but in detail essentially as in *canfieldae*. Similar to *A. l. peninsulae* in color but upper parts with a mikado brownish instead of a more or less distinctly orange cinnamon suffusion, and cranial characters distinctive. Differing from *A. l. leucurus* in darker color, longer tail and cranial details.

Color.—Type: Upper parts in general light mikado brown moderately mixed with black, except on outer sides of limbs and shoulders where the mikado brownish element is nearly pure, interrupted by the usual white

[1] Received May 27, 1929.

[2] Trans. San Diego Soc. Nat. Hist. 5(15): 243. Feb. 27, 1929.

stripes along upper part of sides; sides of face and neck grayish; back of neck and area between shoulders with a grayish admixture producing a distinctly grizzled effect; under parts and inner sides of limbs dull whitish, this color extending well up but ending abruptly along sides of body; hind feet vinaceous cinnamon along outer sides to toes, the inner sides and toes whitish; tail above mixed black and white, with a mikado brownish suffusion near base, below dull white along middle, the hairs along sides with a broad subterminal black zone, and white tips. Some specimens are paler and grayer in general color, the outer sides of hind limbs varying to near vinaceous cinnamon.

Skull.—Closely resembling that of *A. l. canfieldae*, but larger; auditory bullae small and interpterygoid fossa wide about as in *canfieldae*. Similar to that of *A. l. peninsulae* in size, but auditory bullae usually much smaller. Differing from typical *leucurus* in larger size, broader interpterygoid fossa, smaller auditory bullae and heavier dentition.

Measurements.—Type: Total length, 228 mm.; tail vertebrae, 80; hind foot, 37. Two adult topotypes, respectively; 222, 228; 80, 83; 37, 38. *Skull* (type): Greatest length, 40; condylobasal length, 37.1; zygomatic breadth, 23.1; breadth of braincase (at notch behind zygomata), 18.5; interorbital breadth, 10.4; least postorbital breadth, 14.6; length of nasals, 12.1; maxillary toothrow, 7.2.

Remarks.—Ammospermophilus l. canfieldae occupies the extremely arid central section of the peninsula of Lower California, including the Vizcaino Desert, intergrading to the north with *A. l. leucurus* and *A. l. peninsulae*. It is somewhat intermediate in color and differs from both of the more northern forms in cranial details, as pointed out by its describer.

To the east, and southward of the Vizcaino Desert region to Cape San Lucas, much of the land surface of the peninsula consists of rugged lava beds and mountains of moderate elevation, with broad level plains only in the vicinity of Magdalena Bay, and extending across to the Gulf side at La Paz. This generally broken southern section is inhabited by the new form, *A. l. extimus*, here described. It more nearly resembles *peninsulae* than the nearer geographic neighbor *canfieldae* in color, but differs in tone as pointed out. Some specimens from the desert plain near La Paz are paler than usual in the subspecies, but others agree closely with topotypes. Specimens from the type locality and elsewhere indicate that *extimus*, the most southern form of the genus, wears a short, rather bristly coat throughout the year instead of acquiring the long, full, soft and especially on the underparts, somewhat silky winter pelage common to the more northern subspecies.

Specimens examined.—Total number, 56, from Lower California, as follows: Aguaje de San Esteban, 1; Cape San Lucas, 9; Comondu, 9; El Potrero (near Mulege), 2; Guajademi, 1; La Paz, 4; Matancita, 1; Saccaton (type locality 15 miles north of Cape San Lucas), 4; San Bruno, 1; San Ignacio, 6; San Jose (30 miles north of La Purisima), 2; San Jose del Cobo, 5; San Juanico Bay, 2; San Pablo, 6; Santana, 3.

ZOOLOGY.—*Observations on the morphology and physiology of nemas; including notes on new species.*[1] N. A. COBB, United States Department of Agriculture.

1. A NEW SUBGENUS OF RHABDITIS

There is a group of slender-tailed amphigonic rhabdites having lips and pharynx as shown in Fig. 1, the males of which have weakly developed bursas. Such rhabdites have been described from time to time but no author seems to have had adequate material for a completely satisfactory description. Having examined living specimens of both sexes of a new species of this group I took the occasion to prepare a fuller description of it, and propose it as the type of **Rhabditella,** a *new subgenus* of the genus Rhabditis Dujardin 1845.

Rhabditis (Rhabditella) leptura n. sp. $\frac{2.5}{1.8}$ ... $\frac{15}{3.}$ ... $\frac{20}{3.4}$ ... $\frac{42.5}{3.9}$ ... $\frac{71}{2.2}$ 0.82mm

Thin layers of the transparent, colorless, naked cuticle are traversed by excessively fine, plain, transverse striae, resolvable only with the highest powers. Longitudinal striations, due to the attachment of the musculature, are visible in most regions of the body. No deirids have been observed. The neck is very slightly conoid. The cross section of the pharynx is roundish-triangular; yet the almost imperceptibly sigmoid pharynx is nearly equidiametral throughout, though anteriorly the walls are a trifle more strongly refractive. The glottis is a trifle oblique, but otherwise fairly typical. The oesophagus presents a median, fairly prominent, ellipsoidal swelling, or bulb, two-thirds as wide as the middle of the neck, and a somewhat ellipsoidal, or obscurely pyriform posterior bulb two-thirds as wide as the base of the neck,—both swellings of approximately the same diameter. The median swelling presents an elongated, obscure but rather large, valvular apparatus, while the cardiac bulb presents a rather strongly refractive, somewhat three-fold, striated valvular apparatus, located a little in front of the middle of the bulb. At the nerve-ring the oesophagus is one-third, and in front of the cardiac bulb about one-fourth as wide as the corresponding portion of the neck. There is a distinct cardiac collum constituting a rather broad constriction, so that the anterior portion of the intestine through a distance nearly equal to one body-width enlarges from about one-third to five-sixths as wide as the body. This appearance, however, is somewhat variable. The nerve-ring surrounds the oesophagus obliquely. The intestine, the lining of which is somewhat refractive, is made up of cells of such size that probably only about two are presented in each cross section; these cells contain granules of variable size, which are not strongly birefringent. With crossed nicols there is no suggestion of a St. Andrew's cross;—not at all like the strong birefringence of *R. monohystera.* The posterior lip of the anus is very slightly raised. The rectum, whose lining is only slightly refractive, is one and one-

Fig. 1. Front and dorsal view of the head of *Rhabditella leptura.* The beginning of the œsophagus is shown in the lower illustration.

third times as long as the anal body diameter. The vulva is slightly depressed, though its lips are slightly elevated. The ovaries extend two-thirds the distance back to the vulva, and are only about one-sixth as wide as the body of the female. The smooth, thin-shelled, ellipsoidal eggs, about as long as the body is wide and two-thirds as wide as long, have been seen in the uteri one at a time. Their yolk is made up of closely packed, faintly refractive, spherical granules, scattered among which are a few exceedingly small granules less than one micron in diameter.

2.3 ... 18 ... 24 ... 11 ... 15 ... 0.61mm
2.1 ... 3.6 ... 4. ... 4.2 ... 5.1

There are two, equal, separate spicula. The nema must be tipped a little in order to bring the slightly developed obscure bursa into profile view. The foremost papilla, or bursal rib, is somewhat variable in position and is sometimes found nearly as far forward as the proximal ends of the spicula. Fig. 2.

The testis is reflexed at its free end for a distance equal to about two body diameters. This portion of the testis is only about one-fourth as wide as the body, though it is very slightly swollen at its extremity. Behind the flexure for some little distance the testis still remains narrow,—only a little wider than the reflexed portion lying alongside. Then, however, it rather suddenly enlarges and soon becomes half as wide as the body and so continues, enlarging slightly, however, for three or four body widths. In this portion of the testis the spermatocytes pass through their growth period; they appear as if in two rows and in pairs side by side, and one gets the impression that these pairs are twin cells. Their nuclei are large, becoming at last half as wide as the elongated spermatocytes themselves, i.e. one-fifth as wide as the nema About halfway from the blind end of the testis to the anus the full grown spermatocytes, here half as wide as the body and about as long as wide, apparently break successively into quartets, the resulting subspherical cells being a little more than one-fourth as wide as the body. For a distance equal to about two body diameters forward from the spicula the sexual organ is narrower,—about one-third as wide as the body. Whether the cells of the quartet divide further remains unknown.

Examination of one of the members of a quartet indicated the probable presence of about seven chromosomes.

Habitat: Decaying fruit of *Iuffa acutangula* from Tela, Honduras, October, 1926. Sent by Horace S. Dean.

Diagnosis: Rhabditella subg. nov. Rhabdites having lips and pharynx as shown in Fig. 1, the males of which have a weakly developed costate bursa and long slender tails.

Diagnosis: **Rhabditis (Rhabditella) leptura** n. sp. Rhabditellas dimensioned as shown in the formulae; male with two separate spicula, a simple inconspicuous gubernaculum, and with nine bursal ribs arranged as shown in Fig. 2; phasmids present.

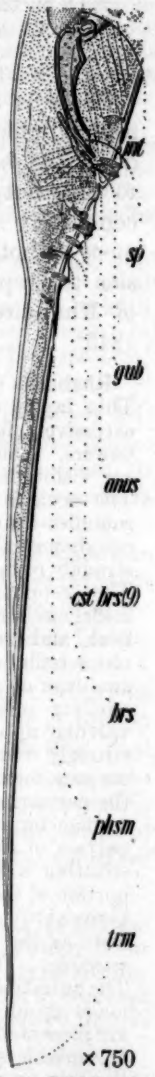


Fig. 2. Tail of male of *Rhabditella leptura* n. sp.

2. MYOLABIA ON A NEMIC PARASITE OF MILLIPEDS

The front view of the lip region of *Thelastoma attenuatum* Leidy, a nema from the intestine of the milliped *Sporobolus marginatus*, gives the impression at first that there is a circlet of 10 "lobes" surrounding the usual three lips. Careful scrutiny shows that two of these ten lobes, the lateral ones, are the external amphids. This leaves 8 other lobes arranged in 4 submedian pairs.

0.5 8 18 28 46 70 78 2.8mm
1.5 4 7.5 9.4 46

Fig. 3. Measurements, front view of the lip region and nearby cross-sections of *Thelastoma* (*Thelastoma*) *spicatum* n. sp.

A similar condition exists on another, and new, species of Thelastoma occurring in the same host, except that in this new nema the amphidial lobes do not so closely resemble the other 8. Fig. 3. In the new species the first slice behind the lip region discloses the anterior parts of 8 muscular fields that extend throughout the body, as may be shown by cross sectioning. Fig. 3. Furthermore, it is quite evident that the 8 labial "lobes" are the external cephalic expression of these 8 longitudinal muscular fields.

It is therefore very interesting to find that in a second new species of Thelastoma, belonging to a new subgenus and infesting a different host (namely the milliped *Fontaria marginata* Say, as found in Virginia, U. S. A., near the District of Columbia) the 8 organs which in *Thelastoma attenuatum* are rather inconspicuous lobes surrounding the true lips, have *entirely displaced the ordinary lips*, forming a lip region prominently set off by constriction, and consisting of 8 prominent subequal contiguous parts folded completely together over the pharynx and constituting lips of a new sort. Figs. 4 & 5. This Fontaria parasite presents, in cross-section, 8 pairs of muscular fields. Fig. 5.

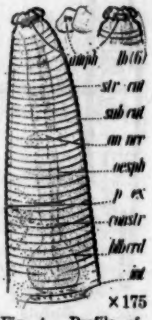
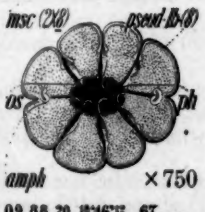


Fig. 4. Profile of head and neck of *Thelastoma* (*Thelastomellum*) *myolablatum*.



0.9 6.8 20 28 46 67 16mm
2.5 4.9 7.2 7.8 47

Fig. 5. Measurements, front view and cervical cross-section of *Thelastoma* (*Thelastomellum*) subg. nov. L. *myolablatum*.

These lips may be called *pseudolabia*;—or, because of their connection with the longitudinal muscular fields of the nema, *myolabia*. No cephalic papillae have as yet been seen on these myolabia.

Diagnosis. **Thelastoma (Thelastoma) spicatum** n. sp. Much like *T. attenuatum* Leidy, but smaller and with shorter spicate tail and more completely differentiated, though still rather vague, myolabia. Dimensioned as shown in the formula. Fig. 3. *Attenuatum* and *spicatum* may occur together in the intestine of the milliped, *Sporobolus marginatus*.

Diagnosis. **Thelastomellum** subg. nov. Thelastomas with 8 well-developed myolabia as in Fig. 5. Type species *T. myolabiatum* n. sp.

Diagnosis. **Thelastoma (Thelastomellum) myolabiatum** n. sp. Dimensioned as shown in the formula, and with lips and amphids as in Fig. 5.

3. SYNGONY IN A NEW NEMA FOUND IN MILLIPEDS

Hitherto undescribed nemic parasites found in the intestine of the milliped *Fontaria marginata* Say and belonging to the genus Thelastoma Leidy, prove syngonic. Thelastoma would be assigned by most authors to the group Oxyuridae.

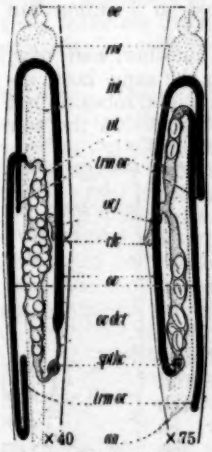


Fig. 6. Slightly diagrammatic drawings of the female gonads of *Thelastoma* (left) and *Thelastomellum* (right). *sp. thc.* spermatheca.

Fig. 7. Scoop shaped syngonic sperms of *Thelastomellum.*

The discovery of syngony in this group opens up an interesting field for speculation and research. It has long been felt that the "Oxyuridae" present many resemblances to the rhabdites. The gonism of the rhabdites has been found very varied, particularly through the researches of Maupas. Query: To what extent, now, will the variations exhibited by the rhabdites be found to occur in the "Oxyuridae?"

Male "oxyurids" usually are less common than the corresponding females, quite frequently are rare, and in some cases are unknown. The striking nature of the recorded sex ratios has been explained by saying that the males, being very much smaller, are easily overlooked, and that possibly they die soon after copulation; and that these two factors,—their smallness and (assumed) relatively early death,—account for their supposed rarity.

In the rhabdites the evidence fully warrants the view that syngony has evolved from amphigony with a gradual diminution or disappearance of males;—for many stages between the two extremes still exist as evidence of the possibility of such a change. Therefore the discovery of syngony in the "oxyurids" at once suggests a new explanation of the scarcity of "oxyurid" males, namely, the one now usually accepted in many cases for the rarity of male rhabdites. If this be true of the "oxyurids," it may have a considerable bearing on veterinary and medical questions connected with "oxyurid" parasites in man and domesticated animals, and in other hosts.

Species that have been assigned to the "Oxyuridae" are common parasites of insects and some other annulata.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

GEOLOGICAL SOCIETY

450TH MEETING

The 450th meeting was held at the Cosmos Club March 13, 1929, President CAPPS presiding.

Program: J. EDWARD HOFFMEISTER and HARRY S. LADD: *Thickness of elevated coral reefs.* The question of the thickness of coral reefs is discussed and new evidence is presented which indicates that many elevated reefs in Tonga and Fiji are not nearly as thick as previously supposed.

A coral reef is defined as a wave resisting structure composed of calcium carbonate secreted by corals and nullipores living in close association. Elevated structures of this type in Tonga and Vitilevu, Fiji do not seem to exceed two hundred feet in thickness. Since reef-building corals can flourish to a depth of two hundred feet such thin reefs can be explained by normal growth without subsidence.

Detailed studies were made of Eua and Vavau in Tonga (the only high limestone islands in the group) and of Vitilevu in Fiji. The main mass of the limestone in these islands is composed of foraminifera. (*Author's abstract.*)

W. C. MANSFIELD: *Some deep wells near the Atlantic Coast in Virginia and the Carolinas.* Study of cuttings from deep wells along the Atlantic Seaboard corroborates the fact, inferred a number of years ago from the surface distribution of the geologic formations, that the region of the Cape Fear River in North Carolina is upwarped. Depths to crystalline bedrock in five wells are as follows: Fort Monroe, Va., 2246 feet; near Havelock, N. C., 2318 feet; Wilmington, N. C., 1109 feet; Fort Caswell, N. C., 1540 feet; Summerville, S. C., 2450 feet. At Havelock and at Summerville the Upper Cretaceous-Eocene contact lies at a depth of about 700 feet below the surface, but at Wilmington it is a few feet above sea level. (*Author's abstract.*)

W. T. SCHALLER and E. P. HENDERSON: *Mineralogy of potash cores from New Mexico and Texas.* This study was based upon a series of core tests drilled by private companies and also the Government. The cores are $2\frac{1}{2}''$ in diameter. Only the economic material is shipped to Washington, thus the study of the mineral associations and relationships is based upon selected horizons.

About 20 minerals have been definitely determined and if the most common are arranged according to their decreasing order of abundance they appear as follows: Halite, anhydrite, clays and shales, polyhalite, sylvite, carnallite. Polyhalite is far the most widespread and abundant potash mineral so far noted.

The saline minerals show many replacements. Polyhalite is found replacing both anhydrite and to a lesser degree halite. Other minerals such as glauberite and leonite are replaced to form polyhalite. Much of the sylvinite shows enrichment by later sylvite.

The striking mineralogical features are (1) rather constant red color of the potash minerals; color caused by hematite; (2) the presence of thin bands of magnesite in the anhydrite rock, clays and also polyhalite; (3) the reoccurrence of mineral cycles; the anhydrite grading into polyhalite, polyhalite into halite, and the halite into sylvinite; (4) many of the minerals show a sequence of formation. (*Author's abstract.*)

451ST MEETING

The 451st meeting was held at the Cosmos Club March 27, 1929, President CAPPS presiding.

Program: W. S. BURBANK: *A collapsed dome in the Bonanza mining district, Colorado.* The Bonanza district lies at the northeastern edge of the volcanic region of the San Juan Mountains of Colorado. The rocks of the district consist of a series of lava flows, probably of Oligocene age, which are invaded by bodies of closely related intrusive rocks. At least 4,000 feet of essentially horizontal lava flows and some local volcanic piles, ranging from augite andesites to rhyolites, accumulated before the invasion of the larger intrusive bodies. These reached to within the shallow portions of the crust, and domed and weakened it until lava escaped to the surface or the intrusive forces became too weak to support the weight of the overlying rock. The arched rocks collapsed over an area of about 100 square miles and subsided upon the underlying magma.

During the subsidence the lavas broke into a complex series of fault blocks, which were at places steeply tilted. It is believed that the tilting and faulting of the lavas occurred simultaneously. The nature of the faults indicate that forces of both compression and tension were involved in the collapse of the structure. The resulting structure was compared to that of the Bullfrog district, Nevada. Following the subsidence of the region hydrothermal alteration of the rocks occurred and base metal veins were formed in many of the fault fissures. Post-mineral deformation was very slight compared to the pre-mineral deformation. (*Author's abstract.*)

Discussed by Messrs. LOUGHLIN, STOSE, G. R. MANSFIELD and GILLULY.

J. B. MERTIE, JR.: *The Pre-Cambrian sequence of Alaska and Yukon Territory with particular reference to the Pelly Gneiss.* The earliest work on the pre-Cambrian of Yukon Territory, Canada, was done by Dawson and McConnell, in 1887 and 1888. These pre-Cambrian studies were continued in Yukon Territory by McConnell, up to 1905, and in Alaska by Hayes, Spurr, and Brooks from 1891 to 1902. McConnell, in 1905, submitted a pre-Cambrian section of the Klondike district, which constitutes the basis of present sub-division and nomenclature. This work was continued in interior Alaska and Yukon Territory, from 1902 to 1912, by Prindle, Capps and Cairnes, and in Seward Peninsula, by Collier, Smith, Brooks and others. More recently, pre-Cambrian studies have been pursued in Yukon Territory by Cockfield and in Alaska by Mertie. The present sub-division of the pre-Cambrian section is as follows:

Alaska	*Yukon Territory*
	Yukon group:
Pelly Gneiss	Pelly Gneiss
Undifferentiated schists of igneous origin	Amphibolites Sericites and chlorite schist (Klondike Series)
Birch Creek Schist, of sedimentary origin	Nasina series, of sedimentary origin

The Pelly Gneiss is typically developed in Yukon Territory, and in the valleys of Ladue River and Dennison Fork of Fortymile River in Alaska. It consists mainly of gneissoid granitic rocks, ranging in composition from granite to quartz diorite, and passing by differential metamorphism into

feldspathic schists. Augen gneiss is particularly well developed, the augen consisting mainly of orthoclase, in places considerably albitized. Albite is an important constituent among many of the gneisses, occurring in three types as follows: First, original magmatic albite; second, albite and oligoclase-albite, produced by albitization of both orthoclase and plagioclase feldspars; and third, crystalloblastic albite, more often developed in the feldspathic schists.

A somewhat similar formation of altered rhyolitic rocks, known as the Totatlanika Schist occurs south of Tanana River, and the possible correlation of this schist with the surficial phases of the Pelly Gneiss is suggested. The possibility that both these formations may be Paleozoic rather than pre-Cambrian is a contingency not to be overlooked. (*Author's abstract.*)

Discussed by Messrs. MENDENHALL, P. S. SMITH, SCHALLER and PRINDLE.

TAISIA STADNICHENKO: *Microthermal studies of some "mother rocks" of petroleum from Alaska.* Discussed by Messrs. P. S. SMITH, SPENCER, MERTIE, MENDENHALL, WHITE.

452D MEETING

The 452d meeting was held at the Cosmos Club April 10, 1929, President CAPPS presiding.

Informal communications: ROBERT OHRENSCHALL: *Striated river pebbles from Alaska.* Striated pebbles are found in terraces of rivers south of the known limits of Pleistocene glaciation. Similarly scratched pebbles are found in the present channel of the Yukon River, Alaska. It is believed that the striae are caused by the action of rocks held in river ice scouring the channel during the spring "break up." (*Author's abstract.*)

CHARLES MILTON: *Moissanite (natural carborundum) in sediments.* Mr. Milton described an investigation in progress by R. D. Ohrenschall and himself on the widespread though sparing occurrence of moissanite (silicon carbide) in sedimentary rocks, suggesting a cosmic course. Dr. M. I. Goldman in comment cited a French occurrence of diamonds as possibly having a similar extra-terrestrial origin.

W. T. SCHALLER: *A new use for minerals.* The colors of minerals are reproduced in neckties; thus we have patterns in lapis lazuli, sapphire, opal, garnet, malachite, amethyst, etc. Also used as a basis for painting automobiles.

Program: LLOYD W. FISHER: *Origin of chromite deposits.* Chromite as an abundant accessory mineral or as a deposit of commercial importance is restricted to ultrabasic rocks or their derivatives. A comparative study of altered and unaltered chromiferous rocks from all prominent localities shows that chromite may belong to at least three different periods of formation—early or late magmatic, and hydrothermal.

In fresh rocks chromite of early magmatic origin is unfractured and occurs as euhedral or subhedral forms. Crystallization of magmatic chromite and silicates proceeds together after an initial crystallization of the ore minerals. Much of this chromite is resorbed and deposited as late magmatic or hydrothermal chromite.

Chromite of the late magmatic period is often confined to zones of crushed olivine or transects the boundaries of the silicates. It also occurs as elongate forms interstitially between the groundmass minerals. It is usually unfractured and may be subhedral or euhedral in form. This late magmatic chromite, which is of far greater importance than that formed at any other

period, replaces, either partially or completely, the groundmass silicates, and surrounds, embays or cuts these minerals, or penetrates the cleavable minerals.

The chromite of hydrothermally altered rocks may or may not be fractured but the forms are predominantly anhedral. Such chromite is definitely associated with hydrothermal minerals of two distinct periods of crystallization: early—anthophyllite, actinolite, and tremolite; and late—chlorite, talc, serpentine (bastite, antigorite and chrysotile) and magnesite. Chromite of hydrothermal origin occurs interstitially between plates of chlorite and in cleavages of magmatic or early hydrothermal minerals, and in the fibrous zones of bastite and chrysotile. It is difficult, however, to determine quantitatively the amount of chromite deposited along cleavages or interstitially between plates of deuteric minerals by hydrothermal solutions. Such chromite might have been formed during the late magmatic period.

The degree of fracturing of the grains compared with the amount of alteration the rock has undergone, the occurrence of chromite transecting silicate outlines or moulded on their periphery, and the association with hydrothermal minerals as outlined above are criteria for recognition of late chromite.

The type of emplacement of the ore body is suggestive, in part, of chromite being introduced into the country rock. The type of occurrence of the ore body is reflected on a small scale in thin section.

It is indicated that the rôle of hydrothermal solutions as solvents of chromite of early magmatic stage and as transporting agents of late magmatic and hydrothermal chromite is important. (*Author's abstract.*)

EDWARD H. WATSON: *Origin of Maryland pegmatites.* The pegmatites of Maryland are limited to dike swarms within the eastern holocrystalline area of the Piedmont Province, and are associated with plutonic intrusions of gabbro, granite, and ultra-basic rocks. The pegmatites are the final acid differentiates of this series. There is considerable evidence to show that all these rocks were intruded during one magmatic cycle, and were accompanied by extensive regional metamorphism.

Differentiation in the pegmatites can be traced through the following sequence: granite, pegmatitic granite, microcline pegmatite, plagioclase pegmatite, quartz veins. Explosive release, due to a concentration of volatile constituents, is probably one cause of dike formation.

The majority of Maryland pegmatites are high-pressure injections of magma. They show little contact action, even in dolomite; they have the structure of dikes, and have deformed their wall rocks. The hydrothermal facies of these pegmatites include: feldspathization, tourmalinization, pyritization, and epidotization. The Setters formation (pre-Cambrian) around Baltimore has been impregnated with tourmaline for a distance of 20 miles. Tourmaline-pegmatite and tourmaline-quartz veins are probably responsible for this. A few pegmatites are probably entirely of hydrothermal origin.

The replacement of minerals of early formation in pegmatities by others of later formation is abundant in Maryland. The relations are generally simple and the sequence is: microcline, muscovite, plagioclase, quartz, sulphides. The greatest amount of replacement has been of microcline by plagioclase and quartz. This replacement is thought to be a continuous and uninterrupted process, brought about by reactions within the pegmatite, the conditions changing from those typical for a magma to those typically hydrothermal. In many case it is thought that all the minerals now present in the dikes were introduced at the time of the original injection. Thus, at Ilchester, there is a large mass composed of nearly equal amounts of albite, microcline, and quartz

which formed simultaneously. Further differentiation during the injection of the pegmatite produced bodies enriched in plagioclase and quartz. (*Author's abstract.*)

Discussed by Mr. SCHALLER.

JOSEPH T. SINGEWALD, JR., and CHARLES MILTON: *Greisen and associated mineralization at Silver Mine, Missouri.* Silver mine lies nine miles west of Fredericktown, Missouri, on the west side of the St. Francis River. At the river level is the old Einstein silver mine opened on argentiferous sulphide ore a half century ago. A quarter mile back from the river is the Apex mine which was reopened during the World War as a producer of tungsten ore. A mile and a quarter from the river the Ozark Tungsten Company was developing a tungsten ore body in 1927.

Granite country rock has been changed to a topaz greisen along the walls of the ore body. The greisen consists of varying proportions of quartz, sericite, and topaz. Subsequent to griesenization fluorite, wolframite, and the common sulphides were introduced into the wallrock by replacement. These minerals occur disseminated in minute spots, streaks, and veinlets. At the Apex and Einstein mines the wallrock is locally altered to lithium-bearing mica and damourite.

The wolframite in the ore at the Ozark mine ranges in composition from the high manganese to high iron end of the series, frequently with regular crystallographic intergrowths of opaque black mineral and translucent red mineral. It occurs as the matrix of a greisen breccia. It has been extensively altered to a gossan of limonite and goethite containing minute aggregates of ferritungstite and stolzite.

At the Einstein mine sulphides occurred in greater abundance and the ore is argentiferous. A sulphide concentrate consisting mainly of sphalerite and pyrite and containing 22 per cent galena assayed 15 ounces of silver, but no silver minerals were recognized on polished surfaces of the ore. The sphalerite is characterized by an abundance of chalcopyrite inclusions which probably represent unmixing of a solid solution for the most part. The lithium-bearing mica has the optical properties of zinnwaldite but an analysis showed only 0.58 per cent lithium. Cassiterite was found for the first time at this locality and is closely associated with fluorite and zinnwaldite.

The mineralization is related to the typical tin vein type. Tourmaline is the only common member of that type which has not yet been found. The paragenetic sequence begins with a transformation of the minerals of the granite into quartz, sericite and topaz. Then followed arsenopyrite and pyrite, cassiterite, and zinnwaldite. Fluorite began to form while cassiterite was still being deposited and extended into the period of deposition of wolframite, sphalerite, and chalcopyrite which were almost contemporaneous. Galena was the last of the ore minerals deposited. Damourite was a late hydrothermal mineral. Supergene minerals are limonite, goethite, ferritungstite, and stolzite. (*Author's abstract.*)

Discussed by Messrs. C. S. ROSS and FERGUSON.

453D MEETING

The 453d meeting was held at the Cosmos Club April 24, 1929, President CAPPS presiding.

Program: Dr. J. J. SEDERHOLM, Director of the Geological Survey of Finland: *The Origin of granite injected rocks (Migmatites).*

Discussed by Messrs. KEITH and LARSEN.

454TH MEETING

The 454th meeting, was held at the Cosmos Club May 8, 1929, President CAPPS presiding.

Informal communications: L. W. STEPHENSON called attention to the preservation of color markings in specimens of *Exogyra* from the Austin chalk of Texas. A new species of *Ostrea* was also found in a restricted zone one foot thick about ten feet above the *Exogyra* zone. Discussed by Mr. GOLDMAN.

Program: G. R. MANSFIELD: *Structure of the Blackfoot Moutains, Idaho.* The Blackfoot Mountains which lie a few miles southeast of Idaho Falls, Idaho, extend southeastward about 30 miles and occupy an area 6 miles to 15 miles wide. They are broader toward the northwest and Mt. Taylor (Blackfoot Peak), 7,414 feet in altitude, is the highest summit. Most of these mountains are included in the Ammon and Paradise Valley quadrangles.

The older strata, which range in age from Upper Mississippian to Lower Cretaceous, are overlapped in considerable measure by Tertiary sediments and lavas. The mountains are traversed by many folds, large and small, which are broken by thrust and normal faults. The Snowdrift anticline, one of the principal folds, continues 50 miles or more to the southeast. In the southern part of the Blackfoot Mountains (Paradise Valley quadrangle) this fold bears on its west flank a window in the Bannock overthrust, which lies nearly 10 miles back from the front edge of the fault block, as exposed in the Cranes Flat quadrangle to the northeast. Another window in the overthrust occurs in the Chesterfield Range to the southwest (Portneuf quadrangle) and lies 20 miles back from the front. Northwestward in the Ammon quadrangle the Bannock overthrust deploys into three major and many minor branches. In structure sections the folded and faulted rocks are represented as piled up in slices, which rest on a principal fault plane or "sole" in a manner similar to that obtained in Cadell's experiments illustrative of structure in the Scottish Highlands. Horst and graben structures are superimposed on these earlier folds and faults. There are also transverse faults and it is thought that one of these in the Paradise Valley quadrangle may be a tear fault or flow. Possible extensions of the Bannock overthrust and the relations of this fault to overthrusting in the northern Rocky Mountains were briefly discussed Older objections to the contraction hypothesis no longer hold in the light of newer conceptions of the age of the earth and of the behavior of radio-active materials in the earth's crust. Reduction in the earth's volume by gravity and other causes is therefore regarded as the most probable source of the great horizontal stresses which have produced the overthrusts. (*Author's abstract.*)

Discussed by Messrs BUTTS, BAKER, BRADLEY.

L. W. STEPHENSON: *Unconformities in the Upper Cretaceous of Texas.* Discussed by Mr. GOLDMAN.

C. P. ROSS: *History of mining in Idaho.* The mining history of Idaho may be reviewed by means of three charts which summarize the statistics in graphical form. These show that there was considerable placer mining in the sixties, a depression in all mining in the seventies and that lode mining started in the eighties and that the mining of lead-silver ore soon became the dominant factor in the industry. Improvement in metallurgy has recently caused some increase in the production of zinc. The production of copper, never large, reached its peak in 1907 and has since been declining.

Shoshone County has been the outstanding producer almost since the first

discovery in it of the deposits of the Cour d'Alene district and in 1926 produced nearly 94 per cent of the total for the State. Boise and Idaho counties were the dominant producers in the early placer days but have since been relatively unimportant. Blaine, Custer and Lemhi counties had large productions in the eighties and each has had a revival since 1900. Custer County, the least important of the three in the early days, has had the most encouraging revival, while the formerly famous Blaine County had the smallest and most delayed revival of the three. Owyhee County had an early placer boom, followed by active production from lodes in 1867 to 1876 and again in 1889 to 1914, the longest period of mining prosperity anywhere in Idaho outside of Shoshone County.

Production in each of the counties, except Shoshone County, has been governed primarily by discovery of ore and only secondarily by economic factors, and in most the quantity found in any one period was small. Although ores of numerous metals exist, production of lead-silver ore is the only branch of the industry of importance now or likely to become so in the near future. (*Author's abstract.*)

Discussed by Messrs FERGUSON and HEWETT.

A. A. BAKER, JAMES GILLULY, *Secretaries*

SCIENTIFIC NOTES AND NEWS

Dr. PAUL BARTSCH, Curator of Molluscs in the U. S. National Museum, is spending the summer in the lesser Antilles in connection with his second year's work under the grant of the Walter Rathbone Bacon Traveling Scholarship.

Dr. J. W. GIDLEY, of the U. S. National Museum, is visiting localities in Idaho, Montana, Oregon, and Washington to investigate reported finds of fossil vertebrates. He will later visit western museums to examine paleontologic collections.

Dr. C. E. RESSER, of the U. S. National Museum, is continuing his studies of the Cambrian stratigraphy of the Rocky Mountain region, devoting this summer particularly to formations in Idaho and Montana.

Dr. H. S. LADD, of the University of Virginia, is spending several weeks at the National Museum, completing a report on the geology and paleontology of Vitilevu Island, one of the Fiji group. Dr. J. E. HOFFMEISTER, of the University of Rochester, is engaged in a study of corals collected last summer in the Tonga Islands. It is expected that they will aid in determining the geologic history of the islands. Dr. A. F. FOERSTE, of Dayton, Ohio, is continuing his studies of Paleozoic cephalopods, particularly those of Canadian and Ozarkian age, which he and Dr. E. O. ULRICH are describing in monograph form. Messrs. R. W. HARRIS and C. T. MATTHEWS have spent some weeks at the National Museum examining recent and fossil Bryozoa and Ostracoda.

Dr. ALEŠ HRDLIČKA, with Dr. MALY, of Prague, as assistant, is in Alaska in connection with his studies of the American Indian.

Dr. REMINGTON KELLOGG, of the U. S. National Museum, is visiting various museums and private collections, particularly in California, to study the history of the fossil whales. The project is a cooperative undertaking of The Carnegie Institution and the National Museum.

The zoological collection of the late Colonel Wirt Robinson, containing 500 specimens of large and small mammals from the eastern United States, an assemblage of large birds, and a collection of insects has been received by the National Museum. Colonel Robinson had presented a large part of his collection of birds to the Museum before his death. The Museum has also received a splendid collection of land, fresh-water and marine shells made by Mr. John K. Townsend in the early part of the last century.

The following men have been recently appointed in the U. S. Geological Survey: ROLAND W. BROWN, paleobotanist to succeed F. H. Knowlton, deceased. ARMAND J. EARDLEY, DAVID A. ANDREWS, WILLIAM G. PIERCE, ALONZO W. QUINN, THOMAS A. HENDRICKS, HAROLD E. THOMAS, and FRANK S. PARKER, junior geologists in the Section of Geology of Fuels; MARLAND P. BILLINGS, assistant geologist in the same section. HOWARD A. POWERS, junior geologist in the Section of Volcanology. EUGENE CALLAGHAN and IAN CAMPBELL, junior geologists in the Section of Metalliferous Deposits, and QUENTIN D. SINGEWALD, assistant geologist in the same section.

Dr. A. S. HITCHCOCK, U. S. Department of Agriculture, left New York, June 8, for London on his way to South Africa. He will attend, by invitation, the South African Association for the Advancement of Science at Cape Town and Pretoria and will give a paper on the *Relation of grasses to man.* The British Association for the Advancement of Science meets this year in South Africa jointly with the South African Association. Dr. Hitchcock will visit Victoria Falls and then, by way of Beira, Portuguese East Africa, will go to Tanganyika and Kenya where he will spend about a month collecting grasses on the table land about Nairobi. He hopes to obtain temperate and alpine species on Mt. Kilimanjaro. The return to London will be through the Red Sea with brief stops in Egypt and Palestine.

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